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VOICE OF THE ELECTRIC UTILITY INDUSTRY

# Eastern states pass ozone pact

Twelve eastern states and the District of Columbia signed the Northeast Ground Level Ozone Control Agreement, committing to implement "interstate strategies and mechanisms which will control ground-level ozone."

The agreement, signed Aug. 4 by governors and the D.C. mayor, formalizes the region's commitment and recognizes the critical role of the Ozone Transport Commission (OTC).

Regional, cooperative air-quality efforts may give some states, and their utilities, an advantage in complying with federal environmental standards.

The Clean Air Act Amendments of 1990 formed the OTC, an interstate governmental body to control ozone. OTC has been working with state environmental agencies on strategies to comply with air quality standards.

Participants adopted NOx boiler requirements in March (*EL&P*, 5/92, p. 1).

The agreement involves Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and the District of Columbia.

Multi-state utilities may benefit when regulations are consistent across state lines, but states still may set more stringent guidelines within the pact. Still, the pact may help utilities, says Chuck Carlin of Northeast Utilities. He suggested that more cohesive rules for other ozone ingredients—nitrous oxides and hydrocarbons—could lessen requirements for stationary sources.

The first filings for states with urban ozone non-compliance areas are due to the Environmental Protection Agency by Nov. 15. Other deadlines vary, depending on the severity of the area's ozone (see table and related story).

### Ozone and other standards

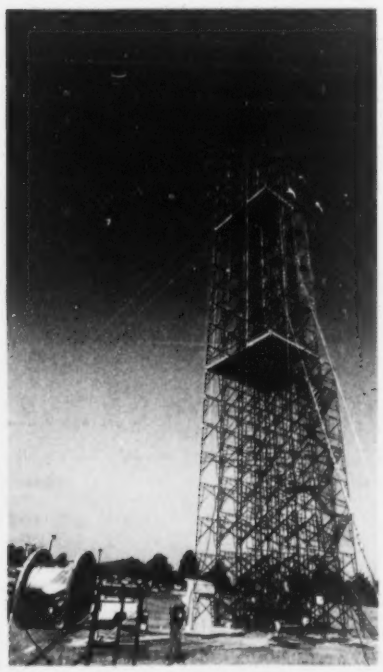
In related news, the EPA recently rejected requests for a tightening of its health-based ozone standard, explaining that provisions in Clean Air Act regulations would decrease ozone.

Other air-quality standards, for particulates, carbon dioxide, nitrogen dioxide, sulfur dioxide, and lead, may also affect utilities in areas where EPA health-based standards are not being met. Carbon-dioxide compliance deadlines are 1995 for moderate regions and 2000 for serious areas.

# Southern study helps ozone compliance

ATLANTA—Ozone-related research is underway as compliance deadlines loom.

How states reduce ozone in non-compliance areas may affect operation of utility fleets and generating facilities. (See related story on northeast states.)



Researchers use this 200-ft tower at the Georgia Institute of Technology to take air samples and study ground-level ozone. The outcome may lead to state limits on utility facilities and fleets in ozone non-attainment areas. Thirteen counties qualify in the Atlanta area.

The Environmental Protection Agency counts 97 U.S. ozone non-attainment areas and divides them into five categories, each with varied deadlines for filing plans and complying. Compliance deadlines start in 1993 (see table).

### Study results

Results of the Southern Oxidants Study may help states limit ozone and comply with these federal standards. Universities, state and federal regulatory agencies, and electric utilities involved with the study are investigating trends related to ground-level ozone, and how weather and other variables contribute.

The study also aims to improve "mathematical models used to predict ozone formation and design control strategies," said one study participant.

Preliminary results are expected by late 1992. The full report may take two years to complete. The $10-million-a-year study started in 1991. Total funding may reach $50 million.

### Increasing concern

Volatile organic compounds (VOCs) and nitrous oxides (NOx) react with sunlight to form ground-level ozone. While upper-atmosphere ozone protects life from ultraviolet sunlight, ground-level ozone has become an increasing air quality concern associated with breathing problems and slower plant growth.

VOCs occur naturally and, like NOx, also result from combustion of fossil fuels. Past efforts tried controlling VOCs, with little effect. Future controls seem likely to focus on NOx, sources said.

### Atlanta chosen as one study site

Research in Atlanta involves more than 200 scientists, a 200-ft tower (photo), balloons and a helicopter to carry instruments. About a million air quality measurements and more than 3000 VOC samples will be taken from 14 area sites, according to John Toon at Georgia Institute of Technology. Collections started July 27.

Atlanta, along with other cities such as Chicago and Boston, are "serious" in the EPA's non-attainment ranking and must comply by 1999.

The program includes an educational outreach program to answer inquiries, and promote discussion and understanding of ground-level ozone issues, Toon noted.

### Utilities, EPA, DOE get involved

Involved agencies and companies include Duke Power Co., Tennessee Valley Authority, The Southern Company, U.S. Environmental Protection Agency, Department of Energy, Electric Power Research Institute, National Oceanic and Atmospheric Administration, U.S. Geological Survey, and National Park Service.

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## LATE NEWS

**Public health** is protected by existing rules on wood-pole preservatives, PCBs, and mixed radioactive wastes, say utilities. Ratepayers would incur unnecessary costs if the EPA approves related rules in April '93 proposed under the Resource Conservation and Recovery Act, says the Utility Solid Waste Activities Group.

**Portland General Electric** will close the Trojan Nuclear plant in 1996, 15 years early, rather than replace steam generators. That least-cost option saves $100 million. A November ballot could close the plant immediately, costing $500 million more. The plant reopened in February after an 11-month shutdown from steam-tube cracks. PGE is operator and 67-percent owner. A Eugene, OR, municipal owns 30 percent; PacifiCorp owns the rest.

# Conference committee works on energy bills

WASHINGTON—A conference committee will have to hurry to work out differences in two major energy bills from the House and Senate.

With less than 25 legislative days left in this Congress, it was unclear if the committee would forge a compromise in time. Key leaders, including President Bush, have been pushing for passage of national energy legislation. The Senate named its conferees in late July, but the House hadn't as of Aug. 11.

If the bill becomes law, the electric utility industry will have a new blueprint on a wide range of provisions, including energy efficiency, industry competitiveness, nuclear licensing, and, possibly, transmission access.

With final language subject to change, industry interests will have people camping outside conference committee doors and lining connecting corridors.

In late July, the Senate approved, 93-3, an amended version of the bill it passed in February. The bill now includes the Senate Finance Committee energy related tax provisions.

### Coal benefits compromise

Intense Senate debate on retired coal-miner health care funds resulted in a compromise that would assesses some coal companies, rather than implement an industry-wide tax. The Senate also agreed to drop language removing Nevada oversight at Yucca Mountain to expedite site characterization.

The House bill contains language on third-party transmission access. The House version bans affiliate transaction under Public Utility Holding Company Act changes; the Senate prefers to give states leeway to decide.

## State Deadlines for Non-Attainment Areas

| EPA Ranking | Compliance Required | Some Cities within These Areas Include... |
|---|---|---|
| Marginal | 11/15/93 | Columbus, Birmingham, Tampa, Portland |
| Moderate | 11/15/96 | Cleveland, Cincinnati, St. Louis |
| Serious | 11/15/99 | Atlanta, Boston, Baton Rouge, Chicago |
| Severe | 11/15/05 | Houston, New York, Baltimore |
| Extreme | 11/15/10 | Los Angeles (only one) |

Source: Environmental Protection Agency

# Report predicts global, green utilities, regional rate increases from IRP

WASHINGTON—21st century electric utilities may compete with "global power companies" that have "widely dispersed business centers," and with "green utilities" that use renewable resources as "real competitive weapons."

Unexpected regional increases in electricity prices also may result as regulators and utilities experiment with various resource options using integrated resource planning (IRP).

These are several views of the industry's future, according to "Electric Power Trends 1992," by Arthur Anderson and Cambridge Energy Research Associates.

### New niche

"For many utilities," said Arthur Andersen's Leonard Kujawa, recent trends "may mean seeking a new market niche that could bring them competitive advantage."

Trends outlined in the report include:

- Increased state regulatory use of IRP. Utility management often must justify future and past actions using least-cost planning or IRP.
- More intense competition from non-utility generators. Maine, California, and Louisiana had 20 percent or more of their total generating capacity supplied by non-utility sources in 1990. The U.S. average was 7.7 percent in 1990. In response, utilities will continue developing partially unregulated affiliated power producers.
- Continued association between GNP and electric demand. Increasing electrification will mean higher electric demand even during recession.
- Growth in innovative and profitable demand-side management strategies.
- Continued cost containment, especially with increased competition and pressures for a cleaner environment. Three states, Indiana, Ohio, and West Virginia have 40 percent or more capacity targeted under the Clean Air Act Amendments of 1990.
- A shift from resource-driven to market-driven utility management.

**Regulatory Incentives for DSM Investments by State**

| | Some Incentive(s) in Place By... | | Types of Incentives Used | | | |
|---|---|---|---|---|---|---|
| | 1989 | 1991 | Balancing Account for DSM Expenses | Rate-Basing | Recovery of Lost Revenue | Bonus |
| California | | ● | ● | ● | ● | ● |
| Colorado | | ● | | ● | | ● |
| Connecticut | ● | ● | | ● | ● | ● |
| Florida | | ● | ● | ● | | |
| Idaho | ● | ● | | ● | | ● |
| Illinois | | ● | ● | | ● | |
| Indiana | | ● | | | ● | ● |
| Iowa | ● | ● | | | | ● |
| Kansas | | ● | | ● | | ● |
| Maine | ● | ● | ● | ● | ● | ● |
| Maryland | | ● | ● | ● | ● | ● |
| Massachusetts | ● | ● | ● | ● | ● | ● |
| Michigan | | ● | ● | ● | | ● |
| Minnesota | | ● | | ● | ● | |
| Montana | | ● | | ● | | ● |
| Nevada | | ● | | ● | | |
| New Hampshire | | ● | ● | | ● | ● |
| New Jersey | | ● | | | ● | ● |
| New York | ● | ● | ● | ● | ● | ● |
| Ohio | | ● | ● | | ● | ● |
| Oklahoma | | ● | | ● | | |
| Oregon | | ● | | ● | ● | ● |
| Pennsylvania | | ● | | ● | | |
| Rhode Island | ● | ● | ● | | | ● |
| Texas | | ● | | ● | | ● |
| Vermont | ● | ● | ● | ● | ● | ● |
| Washington | ● | ● | ● | ● | ● | ● |
| Wisconsin | ● | ● | ● | ● | | |

By late 1991, 28 states had some regulatory incentive in place for demand-side management (DSM) programs.

**Source: "Electric Power Trends 1992," Arthur Andersen/Cambridge Energy Research Associates**

# State regulators want more $SO_2$ education, electric research

SEATTLE—State regulators want investor-owned utilities to invest more in electric power research and development, encouraging a nationwide goal of 1 percent of electric revenues. Just 0.4 percent of investor-owned revenues was invested in R&D in 1987, regulators said.

The move followed a regulatory study that said U.S. utilities have fallen behind when compared to other U.S. industries and electric power research investments in other countries.

The encouragement was in a resolution from the National Association of Regulatory Utility Commissioners' Executive Committee at the NARUC Summer Committee Meetings, July 26-30.

### Nuclear waste, workforce, $SO_2$

NARUC also passed resolutions on $SO_2$ allowance trading education, encouraging more women and minority hiring at utilities, and on monitoring the high-level nuclear waste storage program.

A study released by a NARUC subcommittee suggested the need for more investment in electric power research.

"Electric utilities spend less on R&D [per unit of GNP] than almost every U.S. industry and less than utilities in most industrialized nations," said Electricity Committee Chairman Ashley Brown, an Ohio commissioner, speaking in favor of the resolution.

"We ought to be doing more in investing in the future," Brown said.

The resolution didn't direct the funds toward any particular research body. Separately, some commissioners offered praise for Electric Power Research Institute efforts.

The R&D report said that U.S. industry spends an average of 3.4 percent of revenue on R&D, while the investor-owned electric utility industry spends just 0.4 percent on electric R&D.

The report, by NARUC's Ad Hoc Subcommittee on Electric R&D Funding, also noted a "59 percent decline in U.S. expenditures on energy R&D per unit of GNP from 1981 to 1987."

The U.S. did spend the most in quantity, the report said. The second in amount was Japan, spending 39 percent of what the U.S. did in 1987.

The report said, "The United States appears to be losing ground in funding both total R&D and energy R&D when compared with funding by other countries on a per unit of GNP basis....There is increasing concern that the United States' dominance in research capacity and output will be lost to foreign nations and that we will become a net importer of research."

New York promoted spending 1 percent of revenue on R&D as early as 1971, the report said. More recently, that state commission said it would consider full rate recovery of up to 2 percent for R&D.

State funding to NARUC's research arm, the National Regulatory Research Institute, has not been at its full potential, the report noted. In addition, a speaker from Electricite de France estimated that his utility, the largest in Europe, spends about 5 percent of revenue on R&D.

In the resolution, regulators suggested utilities establish research priorities. R&D reimbursed through rates should be based on revenue requirements of a well-documented research plan. NARUC also suggested programs should be monitored for benefits and R&D funds used for only R&D.

### Other resolutions

NARUC resolutions provide policy guidelines to states, but do not bind them. Among the other resolutions passed, NARUC:

- Supported and encouraged a Pennsylvania Public Utility Commission conference to help regulators, the academic community, media and the industry understand $SO_2$ trading. The intent is to build public and environmental group support for allowance trading as a way to promote least-cost compliance with the Clean Air Act Amendments of 1990.
- Encouraged greater employment opportunities for women and minorities at commissions and among the utilities and carriers commissions regulate.

According to 1991 U.S. Bureau of Labor Statistics, the average U.S. workforce employs 45.6 percent women, 10.1 percent blacks, and 7.5 percent Hispanics. The public utility sector—electric gas, water & sewer and combination utilities—employs 20.7 percent women, 11.5 percent blacks, and 5.1 percent Hispanics.

- Closed its Nuclear Waste Assessment Office, started in 1990, after two years of funding by more than 20 state commissions. Leftover funding will help reopen an expanded office. NARUC hopes the Department of Energy will fund the new office to assess the activities of the federal high-level nuclear waste disposal program. Suggested funding would come from the nuclear waste fund, rather than from states or taxes. Another resolution honored the work of Ronald Callen, Michigan regulatory staff, who ran the office for two years.

# Idaho Power plugs customers into the sun

BOISE, ID—Idaho Power Co. plans to design, own, and maintain solar photovoltaic systems and charge customers a flat fee where doing so is more economical than extending power lines.

If state regulators approve, Idaho Power would be the first U.S. investor-owned utility with such a program, the utility said.

Idaho Power capped its total investment in the three-year pilot project at $5 million, with the maximum single system cost of $50,000.

A small PV system serving a single residential customer is projected to cost approximately $10,000, the company said. Such a customer's ongoing monthly payment to Idaho Power would be about $160.

The cost for the system and the monthly charge would vary according to the power requirement of the site. Likely sites might include remote residences, vacation homes, stock watering wells, sign lighting, and communication sites.

Any new source as little as a half mile from existing power lines might be economical for solar applications. The company listed average power line construction cost at $20,000 per mile. Costs are higher in rugged terrains.

A system would include solar panels, batteries and possibly a back-up generator in case of lengthy cloud cover. All equipment would remain the utility's property.

Joseph W. Marshall, Idaho Power chairman and chief executive officer, said the program should provide "manufacturers with the assurances of new markets that will encourage them to invest in new manufacturing equipment, and to continue the ongoing trend of declining costs for solar PV products."

Idaho Power believes, Marshall continued, "there are many cost effective applications for solar PV technology."

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# COMMENTARY

## *Publicly owned utilities count with us, too*

T.D. Kilgore, president and CEO of Oglethorpe Power Corp., a large power cooperative based in Tucker, GA, recently wrote *EL&P* a letter complaining that our coverage of the "top 100 electric utilities" is misleading because only investor-owned companies are included.

Said Kilgore, "I am sure that you are aware that municipal and cooperative electric systems provide service to tens of millions of Americans. Yet there is no mention of these electric utilities in your list." He asks if we would consider publishing a parallel article on the top cooperative and municipal utilities.

Mr. Kilgore is correct. The "Top 100 Electric Utilities 1992 Financial Performances" article that appeared in the June 1992 issue of *Electric Light & Power* and the "Top 100 Electric Utilities 1992 Operating Performances" article in this issue cover only investor-owned utilities. While that is clearly stated in the opening of the article, the headline is somewhat misleading. (The "top 100" companies are determined by kWh sales.)

Since it is impossible to compare investor-owned and publicly owned companies by common financial measures—the thrust of the June article—we have tried, in the past, to cover publicly owned companies and cooperatives in separate articles with measures suited to each type of company. Our goal was to do an article measuring individual company performances in the preceding calendar year. Getting the information was the problem. Most of the easily obtainable data on electric companies, such as information from the federal government, is not available that soon. So we used questionnaires mailed to each company augmented by the investor-owned companies' Uniform Statistical Reports and FERC Form 1 reports obtained from each company as data sources.

It is difficult to get enough uniform and timely data on enough companies to do these types of articles. In fact, it proved impossible for the publicly owned companies and cooperatives. Too many cooperatives just did not cooperate.

On the other hand, it has been possible to get the data from most of the investor-owned companies. Apparently, the IOUs are used to putting together the Uniform Statistical Reports and FERC Form 1s by July or August of the following year and they seem more willing, or better able, to fill out a questionnaire earlier in the year providing financial data. So, we have continued publishing the IOU top 100, but were forced to drop the comparable publicly owned reports some years ago.

So, where do we go from here? A more precise headline on the Top 100 IOU reports would be a step in the right direction. However, it remains desirable to do similar reports on publicly owned utilities and cooperatives. I am pursuing Mr. Kilgore's offer to help structure such articles and obtain information. Do you have any ideas?

**Robert W. Smock, Editorial Director**


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# LETTERS

### Publicly owned utilities

I would like to register a complaint over your June article entitled, "The Top 100 Electric Utilities." This misleading title suggests that all electric utilities were considered, when, in fact, only investor-owned companies are featured.

I am sure that you are aware that municipal and cooperative electric systems provide service to tens of millions of Americans. Yet, there is no mention of these electric utilities in your list.

Would you consider publishing a parallel feature that focuses on cooperative and municipal utilities? Oglethorpe Power Corp. would be glad to assist in gathering and formatting the first set of data to help make this task easier.

You have been gracious in your coverage of many news items relating to electric cooperatives in general and Oglethorpe Power in particular. We are grateful for this coverage and respectfully request that you consider our suggestion as one that could improve the quality of your publication and enhance service to your many readers.

*T.D. Kilgore*
*President and CEO*
*Oglethorpe Power Corp.*

### WEPCo keeps Milwaukee

Competition is a hot issue in the electric utility industry, as you are well aware. Fortunately, competition hasn't affected Wisconsin Electric Power Co. to the degree the July issue of *Electric Light & Power* indicated.

The first paragraph in the article "WP&L, PEPCO take top honors in *EL&P*'s third annual substation design competition," states that "WP&L serves southern Wisconsin, including Milwaukee." The next paragraph refers to a connection point at a rural 138-kV substation "outside Milwaukee".

While we applaud WP&L's award for its substation design, we are not about to award them the city of Milwaukee, the site of Wisconsin Electric Power Co.'s headquarters.

Wisconsin Electric serves the Milwaukee area, as well as most of southeastern Wisconsin, portions of east-central and northern Wisconsin, and a large share of Michigan's Upper Peninsula. But the closest WP&L comes to Milwaukee is about 40 miles from the city, and close only counts in horseshoes.

*John Bartel*
*Senior Public Information Rep.*
*Wisconsin Electric Power Co.*

### Larger than Linden plant

To the best of my knowledge, the 663-MW Doswell Limited Partnership combined-cycle electric generating facility is now the largest operating non-utility generator in the United States. Certainly, it is larger than the [614 MW] Linden Cogeneration plant profiled in *EL&P*'s May 1992 issue. Doswell, in Hanover County, VA, started commercial operation May 9, 1992.

*August Wallmeyer*
*Wallmeyer Communications*
*for Doswell Limited Partnership*

# NEWS BRIEFS

JILL MINNER, Assistant Editor

## FERC approves merger of Iowa Power, IPS

The Federal Energy Regulatory commission has approved the merger of Iowa Power Inc. of Des Moines, IA, and Iowa Public Service Co. of Sioux City, IA, to form Midwest Power Systems Inc. "We're pleased that FERC has approved the merger. We have felt the case for merging the utilities is a strong one and regulatory agencies agree," stated Midwest Power Systems Chairman and CEO Russell Christiansen. The merged utility has two operating divisions, Midwest Power and Midwest Gas, according to parent company Midwest Resources. Christiansen says the merger will provide greater rate stability and estimates savings of nearly $89 million through the year 2001. "We now have the ability to move ahead with a stronger, more efficient utility operation that will result in long-term benefits for customers and shareholders," he added.

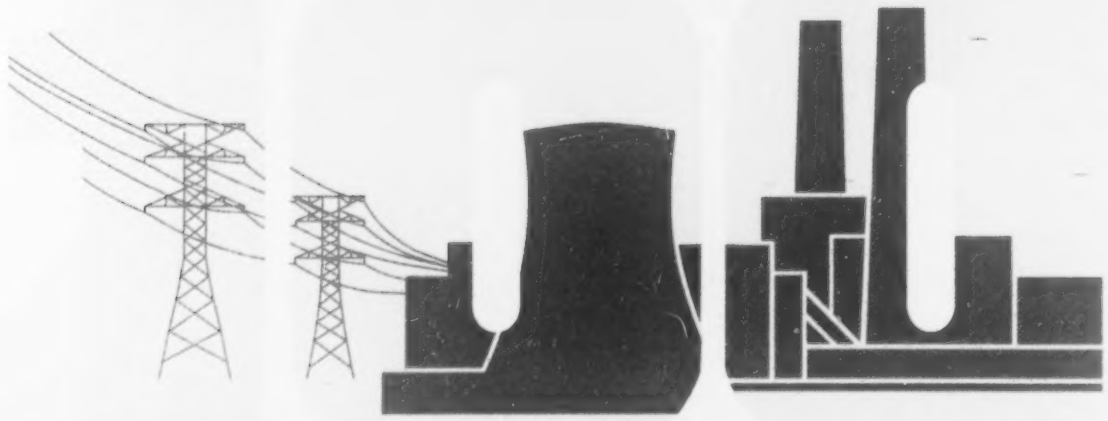
## Bush appoints Waters chairman of TVA

President Bush has appointed John Waters chairman of the Tennessee Valley Authority. Waters, an attorney and former federal co-chairman of the Appalachian Regional Commission, succeeds Marvin Runyon who has moved on to become U.S. Postmaster General. "I appreciate the confidence the President has shown in appointing me to serve as TVA Chairman," said Waters. "I look forward to applying my experience on the board to strenghthen TVA's partnerships with the people we serve." Waters participated in TVA business decisions leading to five years of rate stability, and spearheaded TVA's nuclear recovery effort, according to TVA.

## SMUD commits to 400 MW of renewables

The Sacramento Municipal Utility District said it has launched several solar programs and plans to test a wide range of new solar technologies to add 400 MW of cost-effective renewable energy resources this decade. "By using a free energy source like the sun to generate electricity, we can avoid having to use non-renewable resources," explained SMUD General Manager S. David Freeman. SMUD's residential solar programs include water heating, air conditioning, electricity generation and solar building design. Working with Sandia National Labs and the National Renewable Energy Laboratory, SMUD says it will test advanced evaporative cooling systems, solar absorption and desiccant cooling in Sacramento, CA, homes. Commercially, SMUD has operated a 2-MW photovoltaic plant since 1984, and is part of an industry consortium building a central receiver solar thermal 10-MW power plant in the California desert.

# THE TOP 100 ELECTRIC UTILITIES



# 1991 OPERATING PERFORMANCES

# *Season peaks are down, capabilities are up*

**Henry Stein**
**Senior Editor—Power Production**

Because of 1991's milder weather, the overall average seasonal peak output for the largest investor-owned electric utilities which reported to *EL&P* both for 1990 and 1991 went down, but by less than 1 percent. Because the utilities added more system capability, they increased their average reserve margin by 4 percent. At the same time, their median heat rate dropped less than 1 percent.

**TABLE 1. PEAK DEMAND AND RESERVE MARGINS**

| | 1990 | 1991 | Change |
|---|---|---|---|
| Seasonal Peak (MW) | 405,062 | 404,110 | -0.2% |
| Total System Capability (MW) | 479,266 | 490,970 | 2.4% |
| System Reserve Margin | 18.3% | 22.3% | |
| Total Owned Capability (MW) | 444,209 | 455,062 | 2.4% |
| Average Load Factor | 58.2 | 59.3 | |

### Peak demand, reserve margins

The 0.2-percent decrease in peak out put for the Top 100 (Table 1) was less than the 1.1-percent gain in their annual kilowatthour sales reported by *EL&P* in June. This difference suggests that not only did customers use energy efficiently throughout the year, they also managed to cut back at high-usage times.

The 1990-1991 decrease in system peak continued the 1989-1990 decrease of 2.3 percent.

This '90-'91 Top 100 *decrease* was much different than the North American Electric Reliability Council's (NERC's) reported '90-'91 summer peak *gain* of 1.1 percent and winter *growth* of 2.9 percent. Perhaps the large investor-owned utilities reporting to *EL&P* had found a better way to handle peak demands.

The companies seeing the largest percentage gains in their peak outputs were: Consolidated Edison Co. of New York and Atlantic Energy Inc., each with a 10-percent increase; Central Hudson Gas & Electric Corp., United Illuminating Co., Orange & Rockland Utilities and Delmarva Power & Light Co., each with a 9-percent gain; and Baltimore Gas & Electric Co., General Public Utilities and Public Service Co. of Colorado, each at 8 percent.

Those companies reporting the largest drops in seasonal peaks from 1990 to 1991 were: Portland General Electric Co., with a drop of 15 percent; Montana Power Co. at 9 percent; PacifiCorp at 8 percent; and Washington Water Power Co., with a drop of 7 percent.

The change in reserve margin of *EL&P*'s Top 100 also reversed for those companies reporting in both years. However, the reserve margin increased 4.0 percent 1990-91, after decreasing 1.1 percent 1989-1990.

The average reserve margin of those reporting was 22.3 percent in 1991, which was almost exactly the same as NERC's estimate.

The upswing in reserve margin for the Top 100 could be viewed as good news for the country, since it followed two years of decline in the figures. Many utilities and associated groups, such as NERC and the Edison Electric Institute (EEI), have expressed concern at decreasing U.S. reserve margins.

Those with the largest reserve margins were led by Public Service Co. of New Mexico, which showed a 66-percent margin; Eastern Utilities Associates and Central Maine Power Co., which were at 46 percent; Pacific Gas & Electric Co. at 45 percent; and Oklahoma Gas & Electric Co. with 41 percent. The rest fell below 40 percent.

Those with the lowest reserve margins were located mainly in the Northeast and Midwest. They included: Tucson Electric Power Co. which reported a -1 percent margin; Philadelphia Electric Co. with a 5 percent margin; WPL Holdings Inc., Public Service Co. of Colorado, and Unitil Corp. with 7 percent.

A large part of the overall reserve margin increase can be attributed to the utilities adding 430.1 GW, or 5.7 percent, to their generating capability. In addition, their average load factor rose from 58.2 percent in '90 to 59.3 percent in '91.

And 98 utilities (not all in the Top 100) reported plans for capacity additions to EL&P for the January 1992 forecast report. Their plans add up to much more capacity than the 78 utilities that were planning additions as of January 1991.

Interestingly, more than half of the planned '92 utility additions were to have capacities of less than 100 MW.

EEI forecast in July that total construction expenditures for investor-owned utilities would be 886.9 billion for the three years 1992-1994. This would be an 8.0 percent increase above the institute's forecast for last year for years 1991-1993. Both forecasts included Allowance for Funds Used During Construction (AFUDC).

But EEI also said AFUDC expenditures were projected to remain steady during the '92-'94 period at about 81.3-billion annually. AFUDC represented only 4.9 percent of total utility plant expenditures in '91, the organization added, which was down from an all-time high of 22.5 percent in 1984.

Meanwhile, EEI reported non-utility generator (NUG) capacity made up 8 percent of the U.S. total in 1991. During the '90s, NUGs are expected to provide an additional 26 GW, or nearly one-fifth of capacity additions, said EEI.

### Heat rates

There was a slight improvement in median heat rate achieved by the Top 100 answering the survey. The '90-'91 decrease from a rate of 10,601 to 10,523 Btu/kWh, though minor, did reverse the upward movement shown in last year's report. However, the smallness of the drop reinforced the idea that heat rate improvements have been bottoming out in recent years.

Median heat rates fell every year for seven years ('82-'88), then went up and down in small increments for the next three years ('88-'90), and now were driven down again, but by less than 1 percent.

Some system heat rate leaders switched rankings again in 1991 (Table 4). Commonwealth Energy System held onto first place with a heat rate of 9379 Btu/kWh, but Cincinnati Gas & Electric Co. moved up into the No. 2 spot from No. 3 with a rate of 9886 Btu/kWh, and New York State Electric & Gas jumped from No. 6 to No. 3 with a rate of 9898 Btu/kWh. DPL retained its No. 4 position, and Eastern Utilities Associates, a

**TABLE 2. TOP GENERATING UNITS BY HEAT RATE**
**(capac. factor >50%)**

| Rank & Unit | Capacity (MW) | Reporting Company | Heat Rate (Btu/kWh) |
|---|---|---|---|
| 1 Canal -1 | 572 | Commonwealth Energy System | 8,841 |
| 2 Marshall -4 | 660 | Duke Power | 9,029 |
| 3 Brayton Point -3 | 585 | New England Electric | 9,073 |
| 4 Morgantown -2 | 582 | Potomac Electric Power | 9,145 |
| 5 Kintigh -1 | 821 | NYS Electric & Gas | 9,207 |
| 6 Belews Creek -2 | 1120 | Duke Power | 9,231 |
| 7 J M Stuart -2 | 205 | DPL | 9,268 |
| 8 St Johns River -2 | 125 | FPL Group | 9,283 |
| 9 Monroe -3 | 750 | Detroit Edison | 9,296 |
| 10 Crystal River-4 | 717 | Florida Progress | 9,297 |
| 11 Maalaea Maui -M10 | 14 | Hawaiian Electric | 9,301 |
| 12 Maalaea Maui -M11 | 14 | Hawaiian Electric | 9,301 |
| 13 Maalaea Maui -M12 | 14 | Hawaiian Electric | 9,301 |
| 14 Maalaea Maui -M13 | 14 | Hawaiian Electric | 9,301 |
| 15 Bowen -4 | 877 | Southern Company | 9,307 |
| 16 Ft. Martin -2 | 566 | Allegheny Power System | 9,309 |
| 17 Crystal River -5 | 717 | Florida Progress | 9,319 |
| 18 Belews Creek -1 | 1120 | Duke Power | 9,320 |
| 19 Eastlake -5 | 411 | Centerior Energy | 9,323 |
| 20 J H Campbell -3 | 719 | CMS Energy | 9,333 |

**TABLE 3. TOP SYSTEM HEAT RATES, CONVENTIONAL FOSSIL-FUELED BOILERS**

| | Company | Heat Rate (Btu/kWh) |
|---|---|---|
| 1 | Commonwealth Energy System | 9,336 |
| 2 | Duke Power | 9,448 |
| 3 | American Electric Power | 9,575 |
| 4 | CMS Energy | 9,671 |
| 5 | New York State Electric & Gas | 9,841 |
| 6 | Dominion Resources | 9,844 |
| 7 | Cincinnati Gas & Electric | 9,876 |
| 8 | Potomac Electric Power | 9,885 |
| 9 | DPL | 9,908 |
| 10 | United Illuminating | 9,916 |

## TABLE 4. HEAT RATES, PEAKS, RESERVES, AND FUEL CONSUMPTION

| Rank/Company | Heat Rate (Btu/kWh) | Peak Demand (MW) | Change (%) | Winter or Summer (W or S) | System Capability at time of Peak (MW) | System Reserve Margin (%) | Load Factor (%) | Fuel Consumption: Coal (1000 tons) | Oil (1000 bbl) | Gas (1000 MCF) | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Commonwealth Energy System (H) | 9,379 | 909 | 2 | S | 1,148 | 26 | 61.6 | 0 | 7,738 | 1,367 | 0 |
| 2 Cincinnati Gas & Electric | 9,886 | 4,161 | 5 | S | 4,809 | 16 | 57.6 | 8,745 | 0 | 147 | 0 |
| 3 New York State Electric & Gas | 9,898 | 2,471 | -1 | W | 3,152 | 28 | 69.0 | 6,310 | 29 | 0 | 0 |
| 4 DPL (H) | 9,912 | 2,730 | 3 | S | 3,017 | 11 | 59.0 | 5,717 | 79 | 237 | 0 |
| 5 Eastern Utilities Associates (H) | 9,922 | 879 | 3 | S | 1,287 | 46 | 61.0 | 357 | 2,998 | 0 | 0 |
| 6 Potomac Electric Power | 9,925 | 5,769 | 6 | S | 6,285 | 9 | 52.2 | 6,471 | 4,302 | 9,456 | 0 |
| 7 American Electric Power (H) | 9,953 | 17,556 | 5 | S | 23,397 | 33 | 66.5 | 43,254 | 506 | 0 | 0 |
| 8 Allegheny Power System (H) | 9,956 | 6,238 | 3 | W | 7,715 | 24 | 71.7 | 16,402 | 0 | 0 | 0 |
| 9 Detroit Edison | 9,980 | 8,980 | -1 | S | 10,121 | 13 | 55.9 | 18,852 | 291 | 18,532 | 0 |
| 10 United Illuminating | 9,986 | 1,146 | 9 | S | 1,474 | 29 | 56.2 | 840 | 4,520 | 2,840 | 0 |
| 11 Duke Power | 9,996 | 14,677 | 4 | S | 17,587 | 20 | 59.4 | 9,978 | 106 | 113 | 0 |
| 12 New England Electric (H) | 9,999 | 4,250 | 5 | S | 5,661 | 33 | 60.5 | 3,570 | 6,589 | 1,637 | 0 |
| 13 Southwestern Public Service | 10,003 | 3,097 | -5 | S | 4,012 | 30 | 63.7 | 7,775 | 4 | 50,137 | 969 |
| 14 Florida Progress (H) | 10,007 | 6,056 | 2 | W | 6,971 | 15 | 53.5 | 5,589 | 11,118 | 1,727 | 0 |
| 15 Southern Company (H) | 10,022 | 25,261 | -3 | S | 28,311 | 12 | 58.3 | 44,361 | 269 | 9,819 | 20 |
| 16 CMS Energy (H) | 10,048 | 6,084 | 3 | S | 7,207 | 18 | 62.4 | 7,314 | 536 | 266 | 0 |
| 17 CILCORP (H) | 10,092 | 1,074 | -2 | S | 1,216 | 13 | 58.0 | 2,333 | 0 | 13 | 0 |
| 18 PSI Resources (H) | 10,120 | 4,756 | 4 | S | 5,705 | 20 | 57.4 | 12,331 | 13 | 0 | 0 |
| 19 Green Mountain Power | 10,126 | 309 | 2 | W | 415 | 35 | 85.8 | 18 | 1,188 | 1,821 | 0 |
| 20 SCANA (H) | 10,146 | 3,300 | 2 | S | 4,007 | 21 | 57.0 | 4,350 | 23 | 9,660 | 0 |
| 21 Central Hudson Gas & Electric | 10,164 | 980 | 9 | S | 1,094 | 15 | 62.6 | 874 | 3,439 | 4,143 | 0 |
| 22 TECO Energy (H) | 10,175 | 2,717 | 3 | S | 3,248 | 20 | 60.3 | 6,682 | 651 | 152 | 0 |
| 23 Idaho Power | 10,237 | 2,125 | -2 | S | 2,541 | 20 | 66.0 | 3,097 | 1 | 0 | 0 |
| 24 FPL Group (H) | 10,280 | 14,123 | 3 | S | 16,053 | 14 | 59.1 | 849 | 32,396 | 136,374 | 211 |
| 25 Dominion Resources (H) | 10,295 | 12,939 | -7 | S | 14,863 | 15 | 56.0 | 10,107 | 2,942 | 9,392 | 153 |
| 26 Boston Edison | 10,319 | 2,652 | 4 | S | 3,659 | 38 | 60.0 | 0 | 5,477 | 26,686 | 0 |
| 27 Pennsylvania Power & Light | 10,326 | 5,974 | 6 | W | 7,797 | 31 | 63.6 | 10,192 | 3,375 | 0 | 0 |
| 28 General Public Utilities (H) | 10,332 | 8,271 | 8 | S | 9,782 | 18 | 61.1 | 7,144 | 9,629 | 12,529 | 0 |
| 29 Union Electric | 10,348 | 6,957 | -2 | S | 7,953 | 14 | 55.7 | 10,763 | 19 | 1,295 | 0 |
| 30 KU Energy (H) | 10,352 | 2,894 | 2 | S | 3,426 | 18 | 58.4 | 6,057 | 2 | 5 | 22 |
| 31 LG&E Energy (H) | 10,363 | 2,125 | -1 | S | 2,698 | 27 | 53.9 | 5,202 | 0 | 18 | 0 |
| 32 Niagara Mohawk Power | 10,369 | 6,093 | 5 | W | 7,964 | 31 | 69.1 | 3,372 | 9,623 | 22,045 | 0 |
| 33 PacifiCorp | 10,376 | 7,019 | -8 | W | 8,511 | 21 | 70.0 | 23,826 | 98 | 5,104 | 0 |
| 34 Portland General (H) | 10,388 | 3,136 | -15 | W | 4,075 | 30 | 61.2 | 1,186 | 21 | 10,839 | 0 |
| 35 Pacific Gas & Electric | 10,404 | 15,839 | NA | S | 22,992 | 45 | 60.5 | 0 | 661 | 218,767 | 0 |
| 36 Orange & Rockland Utilities | 10,421 | 1,001 | 9 | S | 1,188 | 19 | 50.9 | 738 | 1,123 | 11,047 | 1,000 |
| 37 DQE (H) | 10,425 | 2,402 | NA | S | 2,798 | 16 | 60.3 | 4,584 | 50 | 204 | 0 |
| 38 Carolina Power & Light | 10,436 | 8,471 | 4 | S | 9,867 | 16 | 56.2 | 8,066 | 177 | 138 | 1,630 |
| 39 SCEcorp | 10,447 | 16,709 | -5 | S | 20,875 | 25 | 56.5 | 5,436 | 113 | 143,302 | 0 |
| 40 IPALCO Enterprises (H) | 10,455 | 2,583 | 3 | S | 2,883 | 12 | 56.4 | 6,001 | 55 | 0 | 11 |
| 41 Central & South West (H) | 10,461 | 10,203 | -2 | S | 13,864 | 36 | 60.4 | 17,449 | 279 | 240,711 | 0 |
| 42 Centerior Energy (H) | 10,461 | 5,361 | 2 | S | 6,308 | 18 | 62.9 | 7,294 | 287 | 18 | 0 |
| 43 Houston Industries (H) | 10,465 | 10,908 | -2 | S | 14,528 | 33 | 61.9 | 17,177 | 48 | 237,272 | 0 |
| 44 Oklahoma Gas & Electric | 10,475 | 4,310 | -5 | S | 6,057 | 41 | 50.3 | 7,422 | 26 | 80,473 | 0 |
| 45 WPL Holdings (H) | 10,492 | 1,863 | 4 | S | 2,002 | 7 | 62.0 | 4,409 | 20 | 508 | 0 |
| 46 Gulf States Utilities | 10,494 | 5,224 | -3 | S | 6,371 | 22 | 66.5 | 2,344 | 21 | 168,285 | 0 |
| 47 Illinois Power | 10,520 | 3,272 | -4 | S | 3,890 | 19 | 55.2 | 6,380 | 166 | 3,298 | 0 |
| 48 Ohio Edison | 10,523 | 5,513 | 2 | S | 6,212 | 13 | 64.2 | 10,365 | 14 | 46 | 0 |
| 49 Tucson Electric Power | 10,550 | 1,319 | -3 | S | 1,309 | -1 | 58.2 | 3,070 | 0 | 2,056 | 0 |
| 50 San Diego Gas & Electric | 10,556 | 2,890 | NA | S | 3,971 | 37 | 56.0 | 0 | 213 | 37,882 | 0 |
| 51 Rochester Gas & Electric | 10,567 | 1,297 | 7 | S | 1,592 | 23 | 60.8 | 734 | 467 | 79 | 0 |
| 52 Washington Water Power (H) | 10,579 | 1,472 | -7 | W | 1,603 | 9 | 57.0 | 1,709 | 6 | 6 | 388 |
| 53 Kansas City Power & Light | 10,589 | 2,751 | 1 | S | 3,090 | 12 | 49.2 | 6,056 | 58 | 735 | 0 |
| 54 Midwest Resources (H) | 10,602 | 2,239 | -2 | S | 2,769 | 24 | 517 | 5,973 | 26 | 1,859 | 0 |
| 55 Pinnacle West Capital (H) | 10,613 | 3,532 | -4 | S | 4,097 | 16 | 58.9 | 6,488 | 49 | 6,906 | 0 |
| 56 CIPSCO (H) | 10,619 | 1,689 | 2 | S | 2,354 | 39 | 57.7 | 4,558 | 26 | 0 | 0 |
| 57 Northern States Power | 10,665 | 7,080 | 5 | S | 7,903 | 12 | 56.2 | 11,226 | 88 | 1,383 | 640 |
| 58 Central Louisiana Electric | 10,684 | 1,233 | 1 | S | 1,706 | 38 | 59.3 | 2,369 | 0 | 29,487 | 0 |
| 59 Baltimore Gas & Electric | 10,695 | 5,910 | 8 | S | 6,608 | 12 | 52.4 | 4,628 | 3,037 | 6,474 | 0 |
| 60 Delmarva Power & Light | 10,707 | 2,430 | 9 | S | 2,645 | 9 | 58.8 | 2,277 | 2,931 | 9,349 | 0 |
| 61 Public Service of Colorado | 10,718 | 3,907 | 8 | S | 4,168 | 7 | 70.1 | 7,27[illegible] | 59 | 2,412 | 0 |
| 62 Atlantic Energy (H) | 10,719 | 1,911 | 10 | S | 2,074 | 9 | 51.3 | 1,0[illegible] | 526 | 5,165 | 0 |
| 63 NIPSCO Industries (H) | 10,725 | 2,496 | -2 | S | 3,382 | 35 | 62.7 | 6,438 | 0 | 7,235 | 0 |
| 64 Wisconsin Public Service | 10,732 | 1,592 | 5 | S | 1,721 | 8 | 68.9 | 3,747 | 12 | 470 | 0 |
| 65 Public Service Enterprise Group (H) | 10,739 | 9,085 | NA | S | 10,713 | 18 | 50.9 | 3,343 | 2,232 | 44,276 | 0 |
| 66 Hawaiian Electric (H) | 10,768 | 1,446 | 3 | W | 1,780 | 23 | 71.0 | 0 | 12,104 | 0 | 0 |
| 67 Philadelphia Electric | 10,772 | 7,096 | 5 | S | 7,436 | 5 | 57.5 | 2,573 | 2,158 | 1,526 | 0 |
| 68 Consolidated Edison | 10,794 | 9,242 | 10 | S | 11,043 | 19 | 48.1 | 0 | 14,909 | 117,972 | 0 |
| 69 UtiliCorp United | 10,808 | 1,623 | NA | S | 3,762 | 132 | 54.3 | 1,954 | 27 | 2,373 | 0 |
| 70 Sierra Pacific Power | 10,842 | 979 | -1 | S | 1,088 | 11 | 73.3 | 839 | 380 | 15,922 | 0 |
| 71 Texas Utilities (H) | 10,847 | 16,952 | -6 | S | 21,849 | 29 | 58.9 | 30,372 | 107 | 335,636 | 0 |
| 72 Entergy (H) | 10,857 | 11,852 | -3 | S | 14,676 | 24 | 60.2 | 6,794 | 676 | 198,302 | 48 |
| 73 Southern Indiana Gas & Electric | 10,918 | 996 | 1 | S | 1,238 | 24 | 52.0 | 2,670 | 0 | 192 | 0 |
| 74 Minnesota Power | 10,923 | 1,306 | 5 | W | 1,573 | 20 | 82.0 | 3,206 | 0 | 0 | 0 |
| 75 Iowa-Illinois Gas & Electric | 10,936 | 1,050 | 0 | S | 1,300 | 24 | 55.0 | 2,613 | 8 | 350 | 0 |
| 76 Puget Sound Power & Light | 10,949 | 4,073 | -12 | W | 4,661 | 14 | 55.0 | 3,451 | 3 | 115 | 0 |
| 77 Montana Power | 10,962 | 1,362 | -9 | W | 1,547 | 14 | 70.0 | 4,022 | 8 | 82 | 8 |
| 78 Nevada Power | 10,977 | 2,373 | 6 | S | 2,625 | 11 | 48.9 | 2,602 | 61 | 3,991 | 0 |
| 79 St. Joseph Light & Power | 10,983 | 325 | 0 | S | 416 | 28 | 52.6 | 583 | 45 | 828 | 0 |
| 80 Commonwealth Edison | 11,009 | 17,733 | 3 | S | 22,359 | 26 | 53.2 | 10,364 | 2,466 | 467 | 486 |
| 81 Kansas Gas & Electric | 11,044 | 1,751 | 1 | S | 2,421 | 38 | 53.1 | 2,925 | 3 | 16,503 | 0 |
| 82 Public Service of New Mexico | 11,098 | 1,018 | -3 | S | 1,691 | 66 | 65.6 | 3,133 | 0 | 44 | 0 |
| 83 Interstate Power | 11,099 | 904 | 1 | S | 1,124 | 24 | 64.6 | 2,118 | 18 | 1,659 | 0 |
| 84 TNP Enterprises (H) | 11,102 | NA | NA | NA | NA | NA | NA | 1,430 | 0 | 620 | 0 |
| 85 IES Industries (H) | 11,127 | 1,608 | 4 | S | 1,944 | 21 | 61.8 | 2,907 | 26 | 9 | 930 |
| 86 Empire District Electric | 11,277 | 678 | 1 | S | 812 | 20 | 54.0 | 1,337 | 8 | 1,130 | 0 |
| 87 Northwestern Public Service | 11,292 | 251 | NA | S | 297 | 18 | 46.9 | 895 | 7 | 36 | 7 |
| 88 KPL Gas Service | 11,306 | 2,077 | 1 | S | 2,485 | 20 | 41.9 | 5,889 | 14 | 4,063 | 0 |
| 89 Central Maine Power | 11,443 | 1,416 | -3 | W | 2,069 | 46 | 78.2 | 0 | 1,817 | 0 | 0 |
| 90 Otter Tail Power | 11,538 | 555 | -1 | W | 729 | 31 | 64.7 | 2,056 | 2 | 0 | 11 |
| 91 Bangor Hydro-Electric | 11,746 | 284 | 5 | W | 382 | 37 | 73.0 | 0 | 104 | 0 | 0 |
| 92 Madison Gas & Electric | 11,831 | 523 | 1 | S | 625 | 20 | 54.0 | 849 | 2 | 760 | 13 |
| 93 Central Vermont Public Service | 11,836 | 399 | 3 | W | 466 | 17 | 66.5 | 33 | 21 | 219 | 33 |
| 94 MDU Resources Group, Inc. | 12,110 | 387 | 1 | S | 454 | 17 | 54.2 | 1,563 | 4 | 189 | 6 |
| 95 UNITIL (H) | 13,837 | 246 | NA | S | 264 | 7 | 61.8 | 0 | 131 | 229 | 0 |
| 96 Upper Peninsula Energy (H) | 13,953 | 137 | NA | W | 188 | 37 | 70.1 | 61 | 4 | 0 | 0 |
| 97 Wisconsin Energy (H) | INFORMATION NOT PROVIDED BY COMPANY | | | | | | | | | | |
| 98 Long Island Lighting | INFORMATION NOT PROVIDED BY COMPANY | | | | | | | | | | |
| 99 Citizens Utilities | INFORMATION NOT PROVIDED BY COMPANY | | | | | | | | | | |
| 100 Northeast Utilities (H) | INFORMATION NOT PROVIDED BY COMPANY | | | | | | | | | | |

(H) - Holding company
NA - Not Available/Not Applicable
0 (in change columns) - Less than 1% change and/or zero in both years

new entity to the list, took the No. 5 spot.

Potomac Electric Power Co. was No. 6; American Electric Power Co. Inc. was No. 7; Allegheny Power System Inc., No. 8; Detroit Edison, No. 9; and United Illuminating held onto the No. 10 place.

When it came to generating units with the best heat rates (Table 2), Commonwealth Energy's Canal-1 became No. 1 (from No. 5 in '90) with 8841 Btu/kWh, followed by Duke Power's Marshall-4 in No. 2 at 9029 Btu/kWh, and then New England Electric's Brayton Point-3, Potomac Electric Power Co.'s Morgantown-2, and Duke Power Co.'s Belews Creek-2.

DPL's J M Stuart-2 was in the No. 6 spot, followed by FPL Group Inc.'s St. John's River-2, Detroit Edison's Monroe-3, Florida Progress Corp.'s Crystal River-4, and Hawaiian Electric Co. Inc.'s four Maalaea Maui units that the company said all had heat rates of 9301 Btu/kWh.

As a comparison, the top spot with the best average heat rate for all conventional fossil-fueled boilers (Table 3) went to Commonwealth Energy with a rate of 9336 Btu/kWh. This was closely followed by Duke Power's 9448 Btu/kWh, American Electric Power Co. Inc. at 9575, CMS Energy Co. at 9671, and New York State Electric & Gas at 9841.

The rest of the top 10, in order, were Dominion Resources Inc., Cincinnati Gas & Electric Co., Potomac Electric Power Co., DPL Inc., and United Illuminating Co.

### Fuels used

Fuels used by the Top 100 in their generating plants included coal, oil, and natural gas (Table 4). "Other" fuels included wood, biomass, and refuse.

From '90 to '91, the reporting companies increased use of fossil fuels—coal consumption stayed almost the same, at approximately 560-million tons; but oil consumption increased by 2.6 percent, to about 156-million bbl, and natural gas usage went up by 7.8 percent, to more than 2299-billion ft³.

For comparison, EEI reported that all investor-owned utilities (IOUs) decreased coal consumption by less than 1 percent, increased oil burned by 2.9 percent, and increased natural gas used by less than 1 percent.

The Energy Information Administration (EIA) predicted that almost 45-50 percent of the new capacity added by the turn of the century will be fueled by natural gas or oil. EIA also predicted that after year 2000, 40-50 percent of new capacity will burn coal.

In addition, the agency differed from both *EL&P* and EEI in noting that all utilities decreased oil consumption in '91 by 19 percent compared to '90.

### Type of generation

Overall, the Top 100 added 2.4 percent to their owned capability between the end of 1990 and the end of 1991 (Table 5). Of this, approximately 317 GW, 69.7 percent, was produced from conventional steam generation, 15.8 percent with nuclear generation, 7.8 percent with combustion turbines (and their variation, combined cycle), 5.9 percent from hydrogeneration, and less than 1 percent with other types of generation. These "Other" types included wind, solar, and geothermal.

Those companies increasing their owned capabilities the most included: UtiliCorp United Inc., which listed an

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increase of a whopping 67.1 percent: Cincinnati Gas & Electric, increasing its amount by 14.9 percent; DPL Inc., with an increase of 13.8 percent; Nevada Power Co., with 11.9 percent; and Baltimore Gas & Electric Co., up 10.6 percent. All the others showed additional owned capabilities of less than 10-percent each.

Large decreases in owned capability were reported by: Green Mountain Power Corp., which lost 18.9 percent; Portland General Electric Co., down by 12.1 percent; and Central Maine Power Co., which dropped 9.2 percent.

Capability aside, the drought affecting many parts of the country is expected to cause a drop in hydro production for the current year.

The "wild card," so to speak, is nuclear power. The utilities, nuclear suppliers, and government agencies are counting on the new initiatives begun in recent years to bear fruit shortly and result in new nuclear plants being built.

So far, however, no electricity generator—be it investor-owned utility, cooperative, municipal, or federal power authority—has been willing to state publicly that it definitely plans to be the first to place such an order.

The Nuclear Regulatory Commission is pushing for its new, simpler licensing process. Meanwhile, the industry is working hard on simpler, safer reactors. Recent surveys by a not-entirely-disinterested U.S. Council for Energy Awareness seem to point to public opinion turning in the industry's favor.

### Transmission & distribution

On the electricity delivery side, the companies reporting in both years added more than 3000 miles of transmission lines to their systems in 1991, for an almost 1-percent gain (Table 5). The addition of over 45,000 miles of distribution line represented almost a 2-percent gain in total mileage.

The utility adding the most transmission mileage was UtiliCorp United, which reported 2,993 additional circuit miles to its system for 1991. No other utility came close to increasing transmission miles by this amount.

Southern Company, however, did add the next highest number of miles to its transmission system, with 316 new circuit miles. It was followed in this regard by Southwestern Public Service Co., which added 158 miles to its transmission line total.

UtiliCorp also led with the most distribution miles added, 7,220. It was followed in this category by Houston Industries, which added 5,539 more miles of distribution line; IES Industries at 4810 miles; and then by Union Electric Co. with 4,424 miles. None of the other reporting companies added nearly these numbers of distribution mileages.

However, Duke Power did add 1849 miles of distribution lines; New York State Electric & Gas put in 1783 miles; Commonwealth Edison added 1565 miles; Allegheny Power System added 1510 miles; General public Utilities Corp. added 1361 miles; American Electric Power put in 1276 miles; and Niagara Electric Power Corp. added 1267 more distribution miles.

Those companies reporting fewer distribution miles in their systems included: PSI Resources Inc., at 1505 fewer distribution miles of lines; and Minnesota Power Corp., with 991 fewer miles.

**Table 5. 1991 Operating Facilities**

| Company | Type of Generation: Conventional Steam (MW) | Nuclear (MW) | Combustion Turbine (MW) | Hydro & P.S. (MW) | Other (MW) | Total Owned Capability (MW) | Capability Change (%) | Power Delivery: Transmission (circuit miles) | Miles Added | Distribution (miles) | Miles Added |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Allegheny Power System (H) | 7,089 | 0 | 0 | 903 | 0 | 7,992 | 0.0 | 4,675 | 25 | 59,349 | 1,510 |
| American Electric Power (H) | 21,120 | 2,110 | 18 | 1,232 | 0 | 24,480 | 2.6 | 21,244 | -485 | 109,793 | 1,276 |
| Atlantic Energy (H) | 771 | 373 | 527 | 0 | 9 | 1,680 | 4.0 | 1,324 | 9 | 10,039 | 95 |
| Baltimore Gas & Electric | 3,492 | 1,850 | 719 | 0 | 3 | 6,064 | 10.6 | 1,154 | 0 | 961 | -121 |
| Bangor Hydro-Electric | 111 | 0 | 0 | 33 | 21 | 166 | -1.2 | 725 | 145 | 3,184 | 93 |
| Boston Edison | 1,797 | 669 | 296 | 0 | 0 | 2,762 | 0.0 | 362 | 0 | 12,476 | 18 |
| Carolina Power & Light | 5,102 | 2,635 | 1,018 | 218 | 0 | 8,973 | -0.5 | 6,166 | 0 | 44,882 | 789 |
| Centerior Energy (H) | 4,384 | 1,858 | 135 | 312 | 4 | 6,693 | 1.3 | 0 | 0 | 23,735 | 269 |
| Central Hudson Gas & Electric | 911 | 98 | 48 | 44 | 5 | 1,106 | 0.4 | 608 | 6 | 7,583 | 53 |
| Central Louisiana Electric | 1,886 | 0 | 0 | 0 | 0 | 1,686 | 0.0 | 1,164 | 0 | 11,650 | 041 |
| Central Maine Power | 589 | 29 | 42 | 366 | 0 | 1,025 | -9.2 | 2,240 | 10 | 19,206 | 406 |
| Central Vermont Public Service | 22 | 20 | 29 | 43 | 2 | 115 | 0.1 | 624 | -0 | 7,704 | 172 |
| Central & South West (H) | 12,709 | 630 | 262 | 0 | 555 | 14,156 | 0.1 | 16,059 | 251 | 64,925 | 983 |
| CILCORP (H) | 1,106 | 0 | 30 | 0 | 0 | 1,136 | 0.0 | 331 | 0 | 8,032 | 17 |
| Cincinnati Gas & Electric | 4,183 | 0 | 475 | 0 | 0 | 4,659 | 14.9 | 1,699 | -14 | 12,218 | 170 |
| CIPSCO (H) | 2,680 | 0 | 0 | 0 | 3 | 2,683 | 1.4 | 4,601 | 41 | 9,096 | 26 |
| Citizens Utilities | INFORMATION NOT PROVIDED BY COMPANY | | | | | | | | | | |
| CMS Energy (H) | 4,043 | 847 | 474 | 1,023 | 0 | 6,387 | 1.9 | 9,859 | -2 | 57,297 | 680 |
| Commonwealth Edison | 9,703 | 11,467 | 1310 | 0 | 22 | 22,522 | 0.0 | 5,083 | 65 | 64,140 | 1,565 |
| Commonwealth Energy System (H) | 1,026 | 41 | 48 | 0 | 17 | 1,132 | 4.2 | 361 | 0 | 9,675 | 79 |
| Consolidated Edison | 6,235 | 931 | 2,128 | 0 | 0 | 9,294 | 0.9 | 431 | 0 | 92,109 | 388 |
| Delmarva Power & Light | 1,818 | 321 | 483 | 0 | 23 | 2,645 | 5.7 | 1,399 | -1 | 10,606 | 226 |
| Detroit Edison | 7,502 | 1,060 | 507 | 917 | 147 | 10,133 | 0.1 | 5,586 | 108 | 39,721 | 423 |
| Dominion Resources (H) | 6,058 | 3,171 | 1,214 | 1,592 | 0 | 12,035 | -2.9 | 5,791 | -129 | 55,542 | 950 |
| DPL (H) | 2,834 | 0 | 149 | 0 | 34 | 3,017 | 13.8 | 1,797 | 2 | NA | NA |
| DQE (H) | 2,106 | 662 | 66 | 0 | 0 | 2,834 | NA | 661 | NA | 11,213 | NA |
| Duke Power | 7,316 | 7,054 | 599 | 2,682 | 0 | 17,651 | 8.3 | 12,606 | 57 | 69,268 | 1,849 |
| Eastern Utilities Associates (H) | 512 | 80 | 0 | 0 | 63 | 655 | -0.1 | 394 | 30 | 5,926 | 645 |
| Empire District Electric | 414 | 0 | 228 | 16 | 0 | 657 | 0.0 | 1,286 | 3 | 5,336 | 86 |
| Entergy (H) | 12,103 | 3,840 | 528 | 70 | 6 | 16,552 | 0.3 | 10,389 | 116 | 78,464 | 948 |
| Florida Progress (H) | 4,167 | 747 | 1,709 | 0 | 0 | 6,623 | 0.8 | 4,355 | 41 | 5,059 | 243 |
| FPL Group (H) | 8,532 | 2,885 | 2,344 | 0 | 14 | 13,775 | 1.1 | 5,567 | 18 | 53,498 | 720 |
| General Public Utilities (H) | 3,507 | 1,428 | 1,480 | 634 | 0 | 7,049 | 2.6 | 6,704 | 5 | 67,114 | 1,361 |
| Green Mountain Power | 12 | 0 | 52 | 36 | 7 | 107 | -18.9 | 281 | -0 | 2,651 | 29 |
| Gulf States Utilities | 5,572 | 655 | 0 | 0 | 0 | 6,227 | -0.3 | 4,185* | 10 | 21,828 | 211 |
| Hawaiian Electric (H) | 1,266 | 0 | 130 | 0 | 157 | 1,553 | -0.1 | 1,491 | 18 | 6,385 | 127 |
| Houston Industries (H) | 11,403 | 770 | 1,410 | 0 | 0 | 13,583 | 0.0 | 3,560 | -11 | 31,341 | 5,539 |
| Idaho Power | 1,007 | 0 | 50 | 1,772 | 5 | 2,834 | 0.5 | 4,650* | -18 | 22,859 | 355 |
| IES Industries (H) | 1,134 | 371 | 203 | 0 | 12 | 1,720 | 1.9 | 4,267 | 14 | 15,257 | 4,810 |
| Illinois Power | 3,340 | 807 | 138 | 0 | 0 | 4,285 | 0.0 | 2,810 | 2 | 19,406 | 74 |
| Interstate Power | 898 | 0 | 114 | 0 | 11 | 1,023 | 7.5 | 2,602 | 6 | 642 | 29 |
| Iowa-Illinois Gas & Electric | 907 | 385 | 128 | 3 | 0 | 1,423 | 0.0 | 963 | 26 | 5,934 | -41 |
| IPALCO Enterprises (H) | 2,755 | 0 | 60 | 0 | 14 | 2,829 | 0.0 | 1,056 | 0 | 9,974 | 201 |
| Kansas City Power & Light | 2,143 | 533 | 414 | 0 | 0 | 3,090 | 1.4 | 1,683 | 12 | 15,190 | 172 |
| Kansas Gas & Electric | 1,906 | 534 | 0 | 0 | 3 | 2,443 | 0.1 | 2,263 | 1 | 10,237 | 129 |
| KPL Gas Service | 2,281 | 0 | 341 | 0 | 0 | 2,622 | 1.3 | 4,400 | -2 | 14,080 | 81 |
| KU Energy (H) | 3,079 | 0 | 59 | 24 | 0 | 3,162 | 0.4 | 4,688 | -1 | 15,491 | -187 |
| LG&E Energy (H) | 2,569 | 0 | 108 | 0 | 0 | 2,677 | -2.2 | 886 | -6 | 5,977 | 179 |
| Long Island Lighting | INFORMATION NOT PROVIDED BY COMPANY | | | | | | | | | | |
| Madison Gas & Electric | 421 | 92 | 115 | 0 | 0 | 628 | -1.2 | 286 | -33 | 1,975 | 91 |
| MDU Resources Group, Inc. | 353 | 0 | 60 | 0 | 0 | 413 | -5.0 | 3,146 | -4 | 4,577 | -6 |
| Midwest Resources (H) | 1,878 | 0 | 625 | 0 | 0 | 2,503 | 0.4 | 3,634 | -142 | 14,902 | 626 |
| Minnesota Power | 1,051 | 0 | 0 | 121 | 0 | 1,172 | 0.4 | 2,150* | 0 | 4,548 | -991 |
| Montana Power | 697 | 0 | 0 | 481 | 0 | 1,178 | 0.2 | 6,853 | -219 | 13,082 | 49 |
| Nevada Power | 1,337 | 0 | 609 | 0 | 30 | 1,976 | 11.9 | 1,468 | 25 | 7,852 | 623 |
| New England Electric (H) | 2,462 | 254 | 0 | 1,164 | 55 | 3,936 | -3.5 | 2,676 | -2 | 26,527 | 778 |
| New York State Electric & Gas | 2,412 | 196 | 0 | 70 | 8 | 2,686 | 0.1 | 4,295 | -303 | 34,813 | 1,783 |
| Niagara Mohawk Power | 3,646 | 1,059 | 164 | 708 | 0 | 5,577 | -0.8 | 9,191 | -88 | 118,673 | 1,267 |
| NIPSCO Industries (H) | 3,179 | 0 | 203 | 10 | 0 | 3,392 | 0.9 | 3,027 | 8 | 8,651 | 62 |
| Northeast Utilities (H) | INFORMATION NOT PROVIDED BY COMPANY | | | | | | | | | | |
| Northern States Power | 3,883 | 1,542 | 1,152 | 262 | 0 | 6,839 | 0.1 | 6,928 | -3 | 41,026 | 395 |
| Northwestern Public Service | 199 | 0 | 49 | 0 | 38 | 286 | NA | 1,280* | NA | 1,910 | NA |
| Ohio Edison | 4,717 | 1,189 | 138 | 0 | 26 | 6,070 | -1.4 | 5,556 | 30 | 29,235 | 342 |
| Oklahoma Gas & Electric | 5,545 | 0 | 111 | 0 | 0 | 5,655 | -0.6 | 4,621 | 17 | 26,601 | 88 |
| Orange & Rockland Utilities | 871 | 0 | 91 | 44 | 0 | 1,006 | 0.1 | 551 | 0 | 6,339 | 290 |
| Otter Tail Power | 534 | 0 | 87 | 4 | 1 | 626 | -0.9 | 5,290 | 6 | NA | NA |
| Pacific Gas & Electric | 7,213 | 2,160 | 418 | 3,724 | 1,291 | 14,806 | NA | 18,342 | NA | 102,733 | NA |
| PacifiCorp | 6,285 | 27 | 15 | 1,103 | 21 | 7,451 | 2.2 | 15,483 | 103 | 44,354 | 139 |
| Pennsylvania Power & Light | 5,800 | 1,905 | 486 | 146 | 22 | 8,359 | 0.4 | 1,308 | 0 | 62,955 | 1,097 |
| Philadelphia Electric | 2,769 | 3,936 | 756 | 1,290 | 13 | 8,766 | 0.0 | 953 | 0 | 30,595 | 102 |
| Pinnacle West Capital (H) | 2,153 | 1,109 | 754 | 4 | 0 | 4,020 | -3.4 | 4,818* | 21 | 18,545 | 275 |
| Portland General (H) | 325 | 745 | 650 | 611 | 6 | 2,337 | -12.1 | 1,896 | -87 | 14,489 | -40 |
| Potomac Electric Power | 4,809 | 0 | 1,025 | 0 | 1 | 5,835 | 6.9 | 814 | 0 | 17,114 | 250 |
| PSI Resources (H) | 5,386 | 0 | 0 | 45 | 196 | 5,627 | 0.0 | 5,426 | 19 | 19,773 | -1,505 |
| Public Service Enterprise Group (H) | 4,341 | 2,807 | 3,064 | 180 | 5 | 10,397 | NA | 1,097 | NA | 31,937 | NA |
| Public Service of Colorado | 2,681 | 0 | 209 | 385 | 16 | 3,271 | 0.2 | 2,645 | 19 | 19,134 | 57 |
| Public Service of New Mexico | 1,181 | 390 | 20 | 0 | 0 | 1,591 | 0.0 | 2,815 | 27 | 7,319 | 96 |
| Puget Sound Power & Light | 858 | 0 | 700 | 310 | 3 | 1,870 | 0.0 | 2,256* | 8 | 16,061 | 557 |
| Rochester Gas & Electric | 541 | 622 | 29 | 47 | 0 | 1,239 | 0.1 | 707 | 1 | 11,247 | 187 |
| San Diego Gas & Electric | 1,611 | 517 | 332 | 0 | 0 | 2,460 | NA | 1,179 | NA | 15,737 | NA |
| SCANA (H) | 2,212 | 590 | 354 | 756 | 0 | 3,912 | 0.5 | 3,227 | 26 | 14,971 | 383 |
| SCEcorp | 8,769 | 2,541 | 1,614 | 1,154 | 8 | 14,086 | 0.0 | 11,676 | 74 | 101,927 | 293 |
| Sierra Pacific Power | 736 | 0 | 37 | 7 | 50 | 830 | -0.7 | 3,642 | 20 | 11,876 | 573 |
| Southern Company (H) | 23,005 | 3,406 | 1,171 | 2,592 | 0 | 30,174 | 1.2 | 26,680 | 316 | 95,854 | NA |
| Southern Indiana Gas & Electric | 1,023 | 0 | 215 | 0 | 0 | 1,238 | 6.4 | 858 | -6 | 4,082 | 33 |
| Southwestern Public Service | 3,945 | 0 | 102 | 0 | 14 | 4,061 | 0.2 | 5,701 | 158 | NA | NA |
| St. Joseph Light & Power | 278 | 0 | 103 | 0 | 0 | 381 | 0.0 | 533 | 0 | 2,355 | 11 |
| TECO Energy (H) | 3,050 | 0 | 188 | 0 | 37 | 3,275 | 2.6 | 1,206 | 39 | 8,916 | 75 |
| Texas Utilities (H) | 17,803 | 1,150 | 975 | 0 | 0 | 19,928 | 0.0 | 12,803 | 42 | 64,558 | 309 |
| TNP Enterprises (H) | 0 | 0 | 0 | 0 | 316 | 316 | 102.6 | 1,501* | 0 | 9,086 | NA |
| Tucson Electric Power | 1,375 | 0 | 218 | 0 | 0 | 1,592 | -5.8 | 1,967 | 70 | 12,078 | 465 |
| Union Electric | 5,351 | 1,125 | 374 | 681 | 5 | 7,536 | 0.0 | 3,190 | 0 | 39,234 | 4,424 |
| United Illuminating | 1,137 | 243 | 0 | 0 | 22 | 1,402 | 0.1 | 91 | -6 | 4,242 | 37 |
| UNITIL (H) | 20 | 3 | 27 | 0 | 0 | 49 | NA | 101 | NA | 1,958 | NA |
| Upper Peninsula Energy (H) | 16 | 0 | 55 | 30 | 0 | 101 | NA | 780 | NA | 2,250 | NA |
| UtiliCorp United | 1,180 | 0 | 308 | 0 | 94 | 1,582 | 67.1 | 4,324* | 2993 | 14,920 | 7,220 |
| Washington Water Power (H) | 459 | 0 | 68 | 940 | 0 | 1,467 | 0.0 | 2,166* | 0 | 10,786 | 0 |
| Wisconsin Energy (H) | INFORMATION NOT PROVIDED BY COMPANY | | | | | | | | | | |
| Wisconsin Public Service | 1,291 | 219 | 186 | 56 | 4 | 1,755 | 2.8 | 1,628 | 0 | 20,119 | 114 |
| WPL Holdings (H) | 1,454 | 213 | 174 | 21 | 1 | 1,862 | -0.0 | 2,799* | 6 | 18,462 | 118 |

(H) - Holding company
NA - Not Available/Not Applicable
0 (in change columns) - Less than 1% change and/or zero in both years
* Pole miles

HENRY STEIN, Senior Editor-Power Production

# LCRA engineers new dam monitoring-and-control system

KANSAS CITY, MO—The Lower Colorado River Authority installed a programmable logic controller-based (PLC-based) system to monitor and control 13 remote hydroelectric units in central Texas from one main control room, said Fred Stearns, senior controls engineer for LCRA. The new system replaced hardwired controls at and between six dams on the Colorado River, he reported at the 1992 ISA/EPRI Joint Controls & Instrumentation Conference. The dams had been connected in pairs, with each downstream dam controlled by its upstream partner through hardwiring.

The project involved installing automated controls at all remotely located units (one dam to contain the central control station), refurbishing control panels, replacing electrical controls and wiring, upgrading existing instruments, installing additional critical instruments, and replacing switchgear at two plants. It was begun in early 1990 and finished in February of this year.

Personal computer (PC) operator interfaces and programmable controller control systems replaced the hardwired controls and remote terminal units (RTUs) at the dam units.

An RTU scheme was considered for automating the hydrogeneration units. However, many more RTUs would have had to be added to the existing ones, as would numerous relays. Because of the costs and complexities, LCRA ruled out the RTU option.

The utility decided to monitor every parameter the operator had had access to at the individual dams, which included such things as turbine guide bearing oil pressure that were only displayed at or near the point of measurement. The idea was to give an operator at the center enough information to properly monitor all units. The system also could be used for the operator to direct maintenance personnel to areas of potential problems.

Available documentation and plant personnel interviews provided the basis for a set of symbolic logics. The symbolic logics then were used to develop the PLC programs.

Using symbolic logic drawings forced the programs to be structured and consistent among units. Differences between units required only minor changes in the logic.

Manual bench boards at the units were left functional, which required that the PLC program be written to mimic the action of the bench board switches. To accommodate initial PLC checkout, and checkout after routine maintenance, each bench board function is available at a PC through the PLC program.

### Alarm coordination

The database in the PC and the PLC program are coordinated, so an alarm condition is signalled to the PC when first noted. Then the operator can take early action before conditions get too far out of control.

If the operator takes no action within preset time limits, depending on the type of problem, and the monitored variable continues to go out of control, the PLC program shuts down the unit using normal shutdown procedure.

Then, if the monitored variable continues to go out of control faster than an orderly shutdown can be accomplished, and it is a variable that affects protective relays, the protective relays trip the unit.

The PLC program "mimics" the action already taken by the relays, so the control system "knows" what has transpired. If a PLC fails, the system sends a failure alarm to the central PC.

PLCs are set to fail with all outputs open, so the unit continues to operate and is protected by its protective relays until someone can be sent to the plant to take manual control or repair the PLC. Note that each plant now has double safety sytems—PLC and protective relays—whereas before it depended on protective relays alone.

Since Wirtz is the centrally located plant, it was chosen as the Master Control Station. Any of the units at any plant can be monitored and controlled from this station.

Wirtz has three 486-based operator interface computers, a 486-based file server for communications between operator and interfaces, and a 386-based computer acting as the communications front end for interfacing with remote plants.

Each operator interface monitor can display any one of several graphic screens that depict portions of the generation equipment. From the screens, the operator can determine plant status and initiate plant action.

LCRA technicians created all the graphic and alarm screens, and built all the databases that provide operator interfaces.

Communication with the remote units is now over LCRA's microwave system from the central control station at Wirtz Dam. The company's own microwave system had uptime better than 98 percent, which was more reliable than the local telephone lines.

Leased phone lines were considered but rejected because of the reliability factor. In addition, the large number of small, rural telephone companies in the service area meant going through three or four of them to reach remote sites from Wirtz. This decreased line reliabilities even further.

The microwave system consists of five channels—each channel is dedicated to the link between one remote plant and the Master Station.

Every plant has a Local Control Station consisting of a 386-based PC communicating with its PLC and operating man-machine interface software, which is similar to that of the Master Station. Thus each local station monitor can display that station's graphics and alarm screens.

A subset of the station's database also resides in the local PC, which can take over station operation with its PLC in case of communications loss with the Master Station. Also, a local mode can be activated by personnel when they are working at the remote station.

LCRA did not hire an architect/engineer for the project, but purchased PCs, PLCs, and interface hardware directly. Instrumentation was bought from local vendors. In-house engineers programmed the PLCs.

The utility felt this procedure resulted in significant cost savings, opportunities for staff development, and a core of in-house expertise. The learned expertise extended beyond the knowledge of monitoring-and-control hardware and software to an in-depth knowledge of the hydrogenerators themselves.

However, a systems integrator was hired to supply and connect the PLCs, operator control stations, and graphic control software.

Unfortunately, doing-it-yourself meant the man-machine-interface (MMI) package took longer to configure and implement than planned. Operator screens had to be reconfigured with less information than originally desired because they took too long to "build." And as of June, the company still did not have the envisioned reporting package working.

### Startup

Startup of each station began with wire checking, then a functional checkout from the bench board, and finally PLC checkout and startup.

The first unit to be started up uncovered most of the problems with the new system. The major problem turned out to be operator actions.

Operators were used to making small adjustments as they ran units, but were not really aware of their actions. They had to learn to allow time for the system to move to sets of conditions, time for the program to recognize the changed conditions, and finally time for the program to make the necessary adjustments for the conditions.

All equipment, excluding a pumpback unit for pumped energy storage at one dam, was operational as of June 1991. At that time, LCRA had 12 operators assigned to Wirtz to control the 13 units. By November, only five operators were needed.

A side benefit of the new system was to increase the full-load generation from the two units at the Starcke Plant from 16.0 MW to 16.6 MW.

After some months of running with the new system, operators noticed that when the plant was running full-load, the excitation voltage was near the rated limit, but the current was lower than rated. The low-side taps on the generator step-up transformers were moved to reduce low-side voltage and increase current to gain the extra 0.6 MW.

## Call for papers—coal utilization conference

WASHINGTON—The Coal & Slurry Technology Association is seeking papers for presentation at a conference it sponsors, to be held April 26-29, 1993, in Clearwater, FL.

The 18th International Technical Conference on Coal Utilization & Fuel Systems will present developments in coal preparation, benefication, liquefaction, transportation, desulfurization, and combustion. Papers dealing with economic, regulatory, and environmental considerations of these technologies are welcome.

Of particular interest, said the organizing committee, are papers relating to the federal government's Clean Coal Technology program, and papers about technologies for retrofitting or repowering coal-fired power plants.

Submit a 400-500-word abstract by Oct. 1, 1992, that summarizes the topic's objective and current status. Send it to: Coal Utilization & Fuel Systems, Conference Organizing Committee, 1156 15th St., NW, Suite 525, Washington, DC, 20005.